In-Flight and Pre-Flight Detection of Pitot Tube Anomalies, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

The health and integrity of aircraft sensors and instruments play a critical role in aviation safety. However, inaccurate or false readings from these same sensors/instruments can lead to improper decision-making resulting in serious if not fatal consequences. This proposal offers a research and development (R&D) effort to demonstrate the feasibility of using advanced data analysis techniques to identify failures in pitot tubes resulting from blockage, icing, or moisture. These data analysis techniques will use existing electrical signals of pitot tube sensors that result from measured processes during in-flight conditions and/or induced signals in pre-flight conditions to detect anomalies in the sensor readings. The proposed method for detecting pitot tube anomalies is referred to as the "noise analysis" technique. This technique has been validated and is currently and routinely used by the proposing firm and others for detecting sensing line blockages of pressure transmitters in nuclear power generating stations; a very similar issue to the concern associated with pitot tube blockages. Typically, the output of a sensor that is measuring a process (e.g. air flow) contains two components: a static (DC) component that represents the process parameter, and a dynamic (AC) component. Through the use of the dynamic component of existing electrical signals, the dynamic response of the sensor can be measured in the frequency domain. As the sensor becomes blocked or degraded, changes to the dynamic response can be observed. Specific examples of this are given in the proposal. Another consideration in this proposal is diagnosing pitot tube sensor anomalies in pre-flight conditions. In pre-flight checks, the pitot tubes reside in mild conditions and will not be measuring a turbulent process. As such, a technique is proposed to induce this type of noise on the sensor input and analyze the resultant output using the same noise analysis technique.

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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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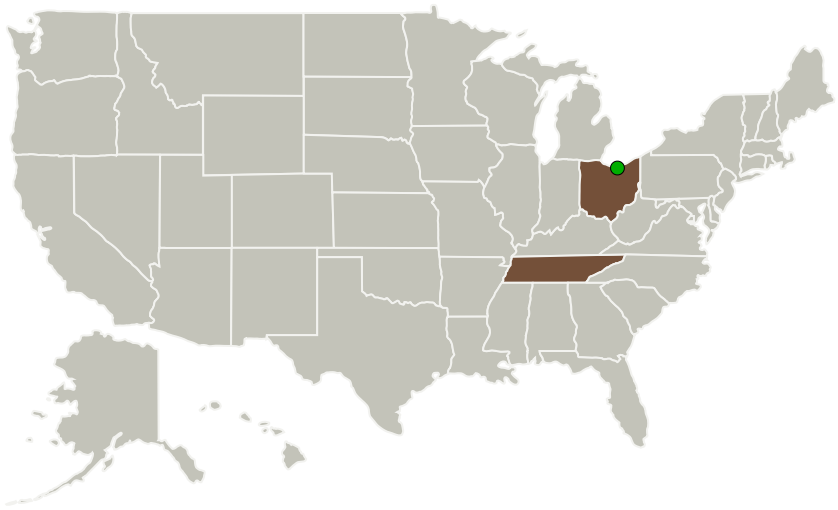
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Analysis and Measurement Services Corporation	Lead Organization	Industry	Knoxville, Tennessee
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Tennessee

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139925)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Analysis and Measurement Services Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

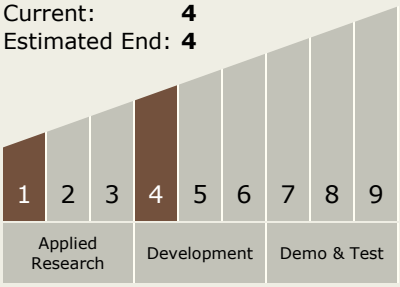
Carlos Torrez

Principal Investigator:

Bradley Orme

Technology Maturity (TRL)

Start: **1**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.3 Aero Propulsion
    - TX01.3.11 Engine Icing

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System